Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – SUMMER 2025

Subject Code:3171917 Date:21-05-2025

Subject Name:Design of Machine Elements

Time:02:30 PM TO 05:30 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Simple and non-programmable scientific calculators are allowed.

1. **Use of Design data book is allowed**.

			MARKS
Q.1	**(a)**	Give the material selection criteria for gears.	**03**
	(b)	Discuss the advantages of helical gear over spur gear and explain about herringbone gear in brief	**04**
	(c)	Explain different types of gear tooth failures, causes and their possible remedies.	**07**
Q.2	**(a)**	What do you mean by coupling? Give its applications.	**03**
	(b)	Discuss the selection criteria of bearings in a particular application.	**04**
	(c)	A pair of spur gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The module is 6 mm. calculate (i) the center distance, (ii) the pitch circle diameter of the pinion and gear, (iii) the addendum and dedendum, (iv) the tooth thickness, (v) the bottom clearance, and (vi) the gear ratio.	**07**
		OR	
	(c)	Write the design procedure of helical spring	**07**
Q.3	**(a)**	What is the difference between protected and unprotected rigid flange couplings?	**03**
	(b)	Write down the expression for Sommerfeld's number..	**04**
	(c)	A single-row deep groove ball bearing No. 6002 is subjected to an axial thrust of 1000 N and a radial load of 2200 N. Find the expected life that 50% of the bearings will complete under this condition.	**07**
		OR	
Q.3	**(a)**	Explain hydrostatic and hydrodynamic lubrication in journal bearing with its application in engineering.	**03**
	(b)	Give and explain classification of couplings in detail.	**04**
	(c)	A rigid coupling is used to transmit 20 KW power at 720 rpm. There are four bolts and the pitch circle diameter of the bolts is 125 mm. The bolts are made of steel 45C8 (Syt = 380 N/mm^2) and the factor of safety is 3. Determine the diameter of the bolts. Assume that the bolts are finger tight in reamed and ground holes	**07**
Q.4	**(a)**	Explain classification of spring.	**03**

	(b)	Discuss geometric progression in detail for gear box design.	**04**
	(c)	Give the gear box design procedure by drawing ray and speed diagram for a 12 speed gear box. State the necessary assumptions taken.	**07**

OR

Q.4	**(a)**	What is compound cylinder explain briefly?	**03**
	(b)	What do you mean by thin and thick cylinder explain with suitable practical example.	**04**
	(c)	A pair of worm gears is designated as, 1/30/10/8 Calculate (i) the centre distance; (ii) the speed reduction; (iii) the dimensions of the worm; and (iv) the dimensions of the worm wheel	**07**
Q.5	**(a)**	What are the functions of piston ?	**03**
	(b)	Write advantages of wire rope. Draw cross section of 7,19 and 37 wires in strand of wire rope.	**04**
	(c)	Write the detail design procedure of crane hook.	**07**

OR

Q.5	**(a)**	List main elements used in hoisting equipments	**03**
	(b)	Explain valve gear mechanism in IC Engine.	**04**
	(c)	The following data is given for the piston of a four-stroke diesel engine: Cylinder bore = 250 mm Maximum gas pressure = 4 MPa Bearing pressure at small end of connecting rod = 15 MPa Length of piston pin in bush of small end = 0.45D Ratio of inner to outer diameter of piston pin = 0.6 Mean diameter of piston boss = 1.4 x outer diameter of piston pin Allowable bending stress for piston pin = 84 N/mm2 Calculate: (i) outer diameter of the piston pin; (ii) inner diameter of the piston pin; (iii) mean diameter of the piston boss; and (iv) check the design for bending stresses.	**07**

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